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ABSTRACT

The importance of decision making to organizational existence has provided ample justification for many forms of research into the complex decision making process. The decision making process in modern, large organizations draws inputs from and provides outputs to many smaller internal decision units. Incompatible or conflicting inputs and outputs may result in wasteful suboptimizations. The research report of an investigation conducted among commissioned officers in the U.S. armed forces examines one possible underlying course of such conflicting inputs and outputs: the existence of differences in decision makers' formal education and work experience backgrounds. A decision making experiment was conducted to obtain information bearing on relationships between choice of alternatives and education background, work experience background, and the decision maker's prescribed role. It was found that there were tendencies toward differences in homogeneity of choice and in adaptability to a change in role among individuals categorized into several educational and experience background categories. Appendixes, which provide the test instruments, education and experience background categories, and test data specifying hypotheses of common choice and change in alternative when role changed, comprise half the document. (Author/JF)

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A STUDY OF THE RELATIONSHIP BETWEEN
DECISION MAKER'S EDUCATION AND
EXPERIENCE AND ALTERNATIVE
CHOICE IN TRADE OFF
DECISIONS

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A School of Systems and Logistics AU-AFIT-SL Technical Report
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Wright-Patterson AFB, Ohio

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TABLE OF CONTENTS

	Page
LIST OF TABLES	iv
LIST OF FIGURES.	v
INTRODUCTION	1
THEORY AND HYPOTHESES.	3
Derived Theory	3
Implications of the Derived Theory	5
Hypotheses	6
METHOD	8
General Approach	8
Variables.	10
The Sample	13
Statistical Techniques	14
RESULTS.	15
Homogeneity of Choice Among Similar Background Categories	15
Homogeneity of Choice Under Differing Role Prescriptions.	18
Differences in Choice Associated with Changes in Role.	18
DISCUSSION	23
Test of the Derived Theory	23
Implications	24

APPENDICES	26
APPENDIX A	27
APPENDIX B	33
APPENDIX C	37
APPENDIX D	44
REFERENCES	53

LIST OF TABLES

Table		Page
1	Categories of the Education and Experience Variable	11
2	Tests of Hypotheses of No Common Choice. . .	16
3	Tests of Hypotheses of Preference Under Different Prescribed Roles	19
4	Relationship of Change in Choice from Alternatives to Change in Role	22
5	Educational Categories by Field of Specialization (representative fields of study).	34
6	Work Experience Categories	35
7	χ^2 One-Sample Test Data--Education	38
8	χ^2 One-Sample Test Data--Experience.	40
9	χ^2 One-Sample Test Data--Education and Experience	42
10	Table 10	45

LIST OF FIGURES

Figure

Page

1

Goal-Constraint Set Selection Model 4

INTRODUCTION

The individual is an imperfect decision maker.

Individuals, even in identical decision situations, do not necessarily make identical choices. They perceive things differently. Many factors probably affect the individual's value system and hence his perceptions of what the problem is, what the constraints are, what is important, what is available, and what he should do.

As Newcomb (1950, p. 333) pointed out, because decision makers differ in their previous experiences and what they learned from them, they inevitably behave in different ways, no matter how fully they may share group norms. Each individual develops his own unique frame of reference and he will see those things that are consistent with that frame of reference (March and Simon, 1958, p. 152). Thus, no two persons need behave exactly alike. On the other hand, similarities in behavior are commonly observed. A number of studies, including those by Dearborn and Simon (1958); Greene (1969); Gross, Mason, and McEachern (1958); and Haire (1955), among others, have shown that individuals possessing certain education or experience background factors in common do exhibit some similar behaviors or expectations.

Simon (1964) has indirectly highlighted the potential effects of differences in individual value systems on

organizational decision making. Simon viewed decisions as being concerned with discovering courses of action that satisfy a set of constraints that define the organizational goal. He theorized that the decision maker will single out from among these constraints one or more as guides in the process of searching for alternatives. The decision will then be aimed at optimizing this 'goal-like' constraint, or generator, subject to the remaining constraints. A significant aspect of Simon's theory is that it points out how, through selection of different goal-constraint sets by decision makers, the organization's goal may be fully met and yet wasteful suboptimization may result. That is, although any one decision may be satisfactory (i.e., meet overall constraints), differences in the direction of the various decision maker's biases may result in undesirable suboptimization.

In this research, formal education and work experience background were posited as factors that affect the decision maker's role behavior through their influence on his value system and hence his goal-constraint set selection.

THEORY AND HYPOTHESES

Derived Theory

The derived theory underlying this research includes work experience and formal education as variables that interact with other variables in determining goal-constraint set selection. The relationship of the formal education and work experience variables to this selection is indirect. That is, education and experience interact with other variables to shape the decision maker's system of expectations and to influence his perception of a prescribed role as sent to him. The decision maker's expectations interact with the prescribed role as he perceives it to form his conceived role. Behavior then results from the decision maker's acting out his conceived role as modified by environmental variables.

A derived model of goal-constraint set selection (Figure 1) explains role behavior (actual selection of a goal-constraint set as evidenced by the decision) as a function of the decision maker's conceived role and the particular environment within which the decision situation exists. The conceived role, in turn, is a function of the prescribed role (expectations of other members of the role set as perceived by the decision maker) and the expectations the decision maker has concerning appropriate behavior. The latter

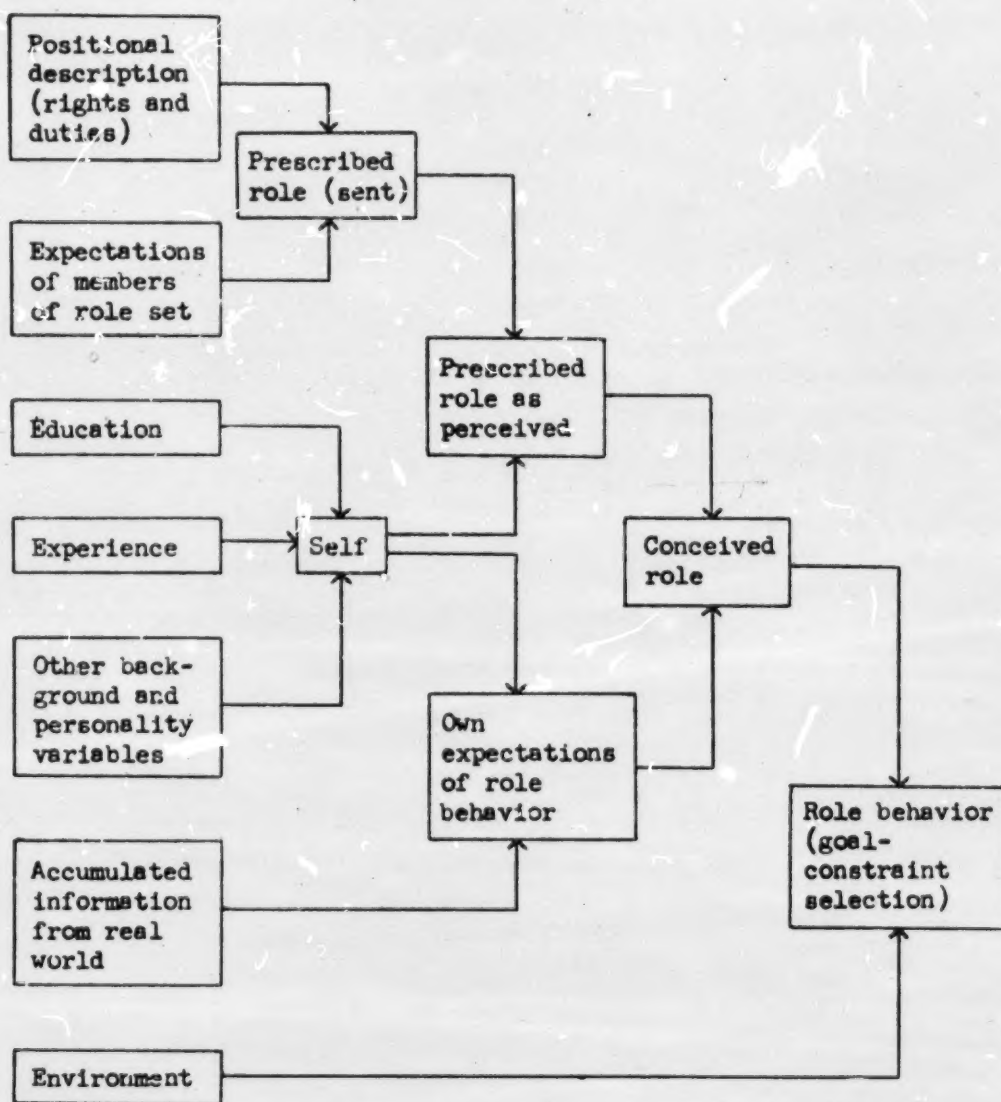


Fig. 1 --Goal-Constraint Set Selection Model

is partly influenced by education and experience. The perception of expectations of other members of the role set is also influenced by experience, including education.

Implications of the Derived Theory

An implication of this theory is that if the decision maker does not perceive that others expect him to behave in a particular way with respect to choice in a particular decision situation, other variables including formal education and work experience will be of relatively greater importance in shaping his behavior. It should then be possible to predict that given the same environment and the same decision situation where there are no perceived expectations of right or wrong, better or worse, or desirable or undesirable behavior, individuals with similar education or experience will behave in a similar manner. If the decision situation involves a choice from among given alternatives, the expectation is that 'similar' individuals will choose the same alternative.

Another implication is that where the decision maker perceives expectations of others relating to his behavior in a particular decision situation, his role behavior may or may not be consistent with those expectations, his own expectations, or both. That is, self-expectations and perceived expectations of others may not be the same or there may be self-role conflicts as suggested by Sarbin (1954). The derived theory does not allow a prediction relative to strength of influence of self-expectations and perceived prescribed role on role behavior. However, as before, it can be predicted that regardless

of what the prescribed role is, individuals with similar education and/or experience will make the same choice given the same prescribed role, environment, and decision situation.

Finally, because educational and work experience backgrounds differ, it might be expected, in the situation where expectations of others are nonexistent, that differences in the alternative choices that are predominant among different education and/or experience groups would preclude identification of a common preferred choice. Then, given a particular prescribed role, if all education and/or experience groups exhibited a preference for the same alternative it might be concluded the influence of prescribed role was more powerful than that of education and/or experience. Also if some groups that had made a particular choice under one role changed their choice when given a different prescribed role while other groups did not, an explanation might be that the relative influence of education or experience was less in the former than the latter.

Hypotheses

Tests of the following specific hypotheses provided the answers necessary to provide support or nonsupport for the implications of the theory. Each of these hypotheses is in relation to the choice made from among alternatives equally satisfactory in terms of organizational goal achievement.

1. Hypothesis 1: Other things being equal, decision makers with similar education backgrounds and subject to the same prescribed role situation will make the same choice from among alternatives.

2. Hypothesis 2: Other things being equal, decision makers with similar work experience backgrounds and subject to the same prescribed role situation will make the same choice from among alternatives.

3. Hypothesis 3: Other things being equal, decision makers with similar education and similar work experience backgrounds and subject to the same prescribed role situation will make the same choice from among alternatives.

4. Hypothesis 4: Decision makers with differing educational and experience backgrounds will not exhibit a preference for the same alternative when role is not prescribed.

5. Hypothesis 5: Decision makers with differing educational and experience backgrounds will exhibit a preference for the same alternative when a common role is prescribed.

6. Hypothesis 6: Decision makers with similar formal education and/or work experience backgrounds that are presented with problems under different prescribed roles will shift to a choice from among available alternatives that is consistent with the behavioral expectations associated with those roles.

METHOD

General Approach

Relationships between choice of alternatives and formal education background, work experience background, combination of education and work experience background, and role were investigated utilizing data obtained in a decision making experiment. Subjects were commissioned officers of the United States armed forces. Each was given three problems and asked to choose what he thought was the best of three alternative solutions to each. Subjects also provided a resume of their work experience and their college level education.

Each of the problems was designed to offer clear cut alternatives, to be brief, to concern a subject with which the decision maker would have some familiarity as a military officer, and to put him in a riskless choice situation. All three problems involved a choice from military hardware items, each of which was stated to fully satisfy all organizationally imposed constraints. The problems, as presented, did not contain any criteria that would point to the superiority of any one alternative with respect to attainment of the organization's goals.

Problems differed with respect to the setting, the positional duties and responsibilities of the decision maker,

and the specific choices available. However, each problem did involve similar performance-cost trade off possibilities. That is, the subject was required to choose an alternative that met or exceeded stated performance minimums at not more than some stated cost. Of the three alternatives within the cost and performance constraints, one offered lowest cost (and lowest performance), another offered highest performance (and highest cost), and the third occupied the middle ground as a compromise between cost and performance.

The research design was a combination of a controlled experiment where an experimental variable (role) was introduced and concomitant changes in the dependent variable were observed and a factorial design where groups having different characteristics of interest were observed and their behaviors compared. In the experiment each individual served as his own control. He first worked a problem where no role was specified. Following this he worked the two additional problems under differing role prescriptions. These role prescriptions were introduced by providing a position title and brief list of formal duties and responsibilities. It was assumed that the decision maker would develop perceptions of the expectations of others within the pretended role set. The basis of these perceptions are the aforementioned positional duties and responsibilities and the individual's knowledge of and experience with people and functions of a similar nature in the military setting.

Variables

The study tested the relationships between three independent variables singly or in combination with a single dependent variable.

The dependent variable was the alternative selected. Each alternative was thought of as offering some different level of hardware performance on a continuous distribution of possible performance. The decision maker in the experiment was given a choice of three levels on a performance continuum that ranged from zero to some unspecified maximum. These three levels were not precisely defined in terms of location on the continuum but they were orderable. Specifically, alternative 3 was greater than alternative 2, which in turn was greater than alternative 1, all in terms of performance.

Formal education and work experience were normative independent variables where respondents were classified on the basis of their backgrounds. Thirteen potential categories of education background were derived based on combinations of four undergraduate and most recent graduate fields of specialization (Table 1). Possibilities included combinations of economics based fields; sciences and applied fields; social sciences, humanities, and arts; and no education at the graduate level or both graduate and undergraduate level. Experience was categorized into one or a combination of five basic experience backgrounds shown in Table 1.

TABLE 1
CATEGORIES OF THE EDUCATION AND
EXPERIENCE VARIABLE

<u>Education*</u>	<u>Experience</u>
00 - no college education	A - operations
10 - science and applied fields	B - scientific, engineering, maintenance, or research and development
20 - social sciences, humanities, and arts	C - technical support (materiel and fiscal)
30 - economics based disciplines	D - technical support (other)
	E - professional

*Note: Full coding used four digits - the first two for undergraduate and the second two for graduate level education

Prescribed role was the independent variable manipulated by the researcher. Subjects were asked to make decisions in three role capacities. One of these was a no role specified capacity and served as the control. The no role situation was created by presenting a problem without any attached positional descriptions or expectations of any sort. It was presumed that in such a situation an individual's own value system will be more free to dictate which constraint will serve as the goal and, consequently, determine the alternative to be chosen. The other two problems presumed the subject would assume a performance oriented and a cost oriented role. Performance and cost were selected as the underlying orientations for these roles because the problem constraints were in terms of performance and cost. Performance and cost were assumed to be constraints well recognized by military officers in general and the subject of trade off between these factors is covered at length in the cost-effectiveness literature. The positions used in the prescribed role problems were those of aeronautical engineer and procurement officer. It was felt that these are representative of positions that evoke performance and cost oriented role expectations, respectively. A pretest of the questionnaire on fifty-nine subjects with extensive military experience supported these assumptions.

The Sample

The sample consisted of those officers of the United States armed forces who were attending United States Air Force professional military schools. Selections for attendance at these schools is competitive. Those officers with the most promise for increased responsibility, growth, and advancement are selected. Officers attending these schools, because of their demonstrated performance in positions of trust and their potential, are likely to be placed in positions of even greater trust. In short, they can be expected to be assigned to those kinds of positions where difficult and far reaching decisions are made. It was assumed, then, that the sample of officers was representative of that future population of top level decision makers who have and will meet the criteria of selection for attendance at a professional military school.

Total enrollment in the three Air Force professional military schools included 1,108 United States military officers. Of these, 586 subjects completed questionnaires. Complete anonymity precluded checking for nonrespondent bias by comparing respondents with nonrespondents. Necessity dictated the check be made by comparing early respondents with late respondents. The rationale for this approach rests on the finding that subjects who send in their questionnaires late are roughly similar to nonrespondents (Oppenheim, 1966, p 34).

No statistically significant differences were found between the responses of early and late respondents at a .01 level of significance.

Statistical Techniques

The chi-square goodness of fit test with Yates correction, as recommended by Lordahl (1967, pp. 202-203) and Hays (1963, p. 586), was used to test hypotheses of preference related to educational experience background, work experience background and role (hypotheses 1 through 5). Hypotheses 1, 2 and 3 involving different backgrounds but similar role prescriptions utilized the responses of all subjects falling in each background category. Tests of hypotheses 4 and 5 involved a random selection of 100 subjects from the total sample. In all cases, following Edwards (1958, p. 152), once the alternative with the greatest frequency was found, the distinction between the other two alternatives was of no interest. A choice of either of the other two alternatives provided information to test the statistical significance of the alternative chosen with the greatest frequency. Consequently, the not most frequently chosen alternatives were combined into a single category simply called "not most frequent"

Hypothesis 6, concerned with difference of choice under changing roles, was tested with the sign test.

RESULTS

Homogeneity of Choice Among Similar Back- ground Categories

Nearly all categories subjected to the chi-square goodness of fit test were found to prefer one alternative to the others in one or more of the problems. However, few categories exhibited a preference in all three problems. Failure to support the hypothesis of a common choice among members of a particular education, experience, or education/experience background category most often occurred when problem 1 (no role) data was tested. A hypothesis that a common choice did exist among members of a background category generally occurred when problem 2 (performance role) and problem 3 (cost role) data was tested. Only four cases, each, of failure to support a hypotheses of common choice were found when testing problem 2 and problem 3 data. Table 2 shows categories subjected to testing of each hypothesis and the results of the test as applied to data from each problem.

The hypothesis that decision makers with similar formal education backgrounds choose the same alternative was supported in all three problem situations for only two of the categories tested. Both of these categories, the sciences and applied fields (1000) and the economics based fields (3000), involved only undergraduate level education. At

TABLE 2

TESTS OF HYPOTHESES OF NO COMMON CHOICE

Hypothesis	Category	Problem			Hypothesis	Category	Problem		
		1 (1)	2 (P)	3 (C)			1 (1)	2 (P)	3 (C)
1	0000			N	3	1000A	X*	X**	X**
						1000B	X**		
	1000	X**	X**	X**		1000F		X**	X**
	1010		X**	X*		1000H		X**	X**
	1030		X*	X**		1010B	X*	X**	X*
	2000		X**	X**		2000A		X*	X**
	2020		X**	X*		2000D			
	3000	X**	X**	X**		3000A		X**	X**
2	3030			X*		3000C	X**	X*	
	A	X*	X**	X**					
	B	X*	X**	X**					
	C	X**	X**						
	D		X**	X**					
	F	X**	X**	X**					
	G		X**	X**					
	H		X**	X**					

Note: An X* indicates a preference found to be significant at $\alpha = .05$. X** indicates a preference found to be significant at $\alpha = .01$. A blank indicates no reason to reject the null hypothesis (of no common choice). N indicates not tested. Only categories representing 15 or more respondents were subjected to testing because of limitations in the use of χ^2 .

another extreme, those respondents with no college level field of specialization (0000) and those with economics based undergraduate plus graduate specialization (3030) did not show a common choice of alternatives in either the first or second problem. The remaining categories tested showed preferences only in the case of problems 2 and 3.

Work experience backgrounds categorized as operations (A); scientific, engineering, maintenance, or research and development (B); and operations plus scientific, engineering, maintenance, or research and development (F) were found to exhibit a common preferred choice in all three problems. The hypothesis that decision makers with similar work experience backgrounds choose the same alternative was only supported in two of the three problem situations for each of the other experience categories. Category C, technical support--materiel and fiscal, differed from these others in that a common preferred alternative was chosen in problem 1 but no common choice could be said to have been made in problem 3.

The hypothesis that decision makers with similar formal education and similar work experience backgrounds choose the same alternative was supported for all three problems in the case of categories 1000A (operations experience and science or applied fields education) and 1010B (scientific, maintenance, engineering, or research and development experience and both undergraduate and graduate education in the sciences or applied fields). Category 2000D, technical support (other) experience and undergraduate education in the social

sciences or humanities, did not exhibit any common preferred choices. Category 3000C, technical support (materiel and fiscal) experience and undergraduate education in an economics based field, exhibited a common preferred choice in problems 1 and 2 but not 3. Other categories exhibited a common preferred choice in problems 2 and 3 only.

Homogeneity of Choice Under Differing Role Prescriptions

As shown in table 3, the random selection of 100 subjects of differing educational and experience backgrounds failed to exhibit a single preferred alternative in the no role problem situation at the .01 level of significance. Hence, there was no support for hypothesis 4.

Hypothesis 5 was tested with both problem 2 (performance role) and problem 3 (cost role) data from the 100 randomly drawn subjects. As shown in table 3, hypothesis 5 was supported at the .01 level of significance in both cases.

Differences in Choice Associated with Changes in Role

Application of the sign test to the choices of groups of subjects under the different prescribed role situations uncovered varying degrees of relationship between choice of alternatives and difference in role. At one extreme, where the sign test was found to be not significant, a null hypothesis (that prescribed role makes no difference in the choice of alternatives) could not be rejected. For other background

TABLE 3
TESTS OF HYPOTHESES OF PREFERENCE UNDER
DIFFERENT PRESCRIBED ROLES

Hypothesis	Problem	Frequency of Choice					N	χ^2
		Alternative	Observed Frequency	Expected Frequency	Alternatives	Observed Frequency	Expected Frequency	
4	1	1	42	33.3	2 & 3	58	66.7	100 3.03
5	2	3	61	33.3	1 & 2	39	66.7	100 33.3**
5	3	3	49	33.3	1 & 2	51	66.7	100 10.4**

Note: ** indicates a preference for the same alternative found to be significant at $\alpha = .01$.
Absence of an asterisk indicates no reason to reject a null hypothesis of no preferred choice.

categories the sign test was found to be significant both in the case of a change from a no role problem to a performance role problem and a change from a performance role problem to a cost role problem. This provided cause for rejecting the null hypothesis and accepting the alternate hypothesis. That is, for decision makers with certain similar backgrounds, role did make a difference. These groups of individuals did tend to choose alternatives that coincided with changed expectations of what is appropriate behavior in a different role. For other background categories, the sign test was significant in the case of the differences between one pair of roles but was not significant in the case of the difference between the other pair. The lack of evidence of a relationship in the latter case weakens the confidence in the alternate hypothesis.

Failure to exhibit a difference in choice from alternatives between the performance oriented problem 2 and the cost oriented problem 3 may have been the result of a methodological deficiency. Several respondents' written comments indicated that problem 3 may have been presented in a way that in some cases prevented measurement of the effect of a change in role. There was evidence that at least some respondents were playing the role but had chosen the higher per per unit cost alternative because they had perceived economies not written in the problem--something not detected in the pretest. In short, there is a possibility that individuals were playing the cost oriented procurement officer role but their choices did not reflect this fact. What was considered the high cost

alternative to the researcher may have been the lowest 'overall' cost alternative to a respondent.

Table 4 shows the results of the sign test as applied to the various education and/or experience categories.

TABLE 4

RELATIONSHIP OF CHANGE IN CHOICE FROM
ALTERNATIVES TO CHANGE IN ROLE

Independent Variable	Education and/or Experience Category		
	Choice Related to Change from No Role to Performance Role and Performance Role to Cost Role ^a	Choice Related to Change from No Role to Performance Role or Performance Role to Cost Role ^b	Choice Not Related to Change from No Role to Performance Role and from Performance Role to Cost Role
Education	1000** 1010** 3000	1030 2000 2030	3010 3030
Experience	A** H**	B C D	F G E
Education/ Experience	1000A** 1010F	1000B 1000F 1000H 1030A 2000D 3000A 3000C	0000A ^c 1000D ^c 1000G ^c 1010B ^c 1030B ^c 1030C ^c 1030E ^c 1030F ^c 2000A

^aInclusion in this column signifies the null hypotheses of no difference in choice of alternatives between no role and performance role and between performance role and cost role were both rejected at $\alpha = .05$. Rejection of both null hypotheses at $\alpha = .025$ is indicated with a double asterisk.

^bInclusion in this column signifies one but not both of the null hypotheses were rejected when $\alpha = .05$.

^cCombined number of pluses and minuses less than 5 for one or both changes in choice.

DISCUSSION

Test of the Derived Theory

Generally, the research results support the derived theory although the influence of formal education and work experience appear to be less than implied in the theory. It was found in tests of hypotheses 1, 2 and 3 that individuals with similar experience or education backgrounds did often behave similarly (prefer the same alternative). This similarity of choice was observed in the case of both no role and prescribed role problems, although frequency of occurrence was greater in the latter than the former case. The greater homogeneity of choice in the prescribed role problems is fully complementary with the results of hypothesis 4 and 5 that supported the importance of role, even among individuals of diverse backgrounds, as related to preference from among alternatives. On the other hand, in the tests of hypothesis 6, there were occurrences of a collective failure of members of some background categories to choose different alternatives, in terms of performance and cost combinations, when given problems implying different behavioral expectations. Such instances point out the probable existence of differences in the relative influence of role and education/experience among background categories.

Implications

Caution must be exercised to avoid making inferences that violate the limitations of the research. Inferences are confined to that population of military officers described or to groups of similar individuals. Further, because the research was macro in nature, implications are necessarily general.

The first of two particular questions this research attempted to answer was: do military officers with similar formal education or work experience backgrounds tend to choose the same constraint as more goal-like? The research provided evidence that members of certain background groups did tend to place the same emphasis on either cost or performance as a more goal-like constraint. That is, they preferred the same alternative in a trade off decision. Particular education backgrounds found to be associated with a homogeneity of choice included undergraduate training only in (1) the economics based disciplines and (2) the sciences or applied fields. Experience backgrounds showing homogeneity were (1) the scientific, maintenance, engineering, and research and development fields, (2) operations, or (3) combinations of the two. The social sciences and humanities education backgrounds and the technical support (other) experience backgrounds were those less likely to exhibit a homogeneity of choice.

The second question this research attempted to answer was: might there be differences in adaptability to changed roles because of constraint biases resulting from educational or

experience backgrounds? Several background categories have been identified whose members did not exhibit a tendency to change their choice of alternatives, as predicted, when confronted with a new problem under a new role that implied a change in behavioral expectations. A presumption is that the background of such individuals had so affected their value systems that they did not play the role or were unadaptable to the role. The social sciences and humanities, no college field of specialization, and work experience in the professions were broad categories that failed to show any significant association between change of choices and change in role. On the other hand a significant association was found between the choices of individuals and the role situations in which they were placed by those who had received undergraduate educations in the economics based disciplines or the sciences or applied fields or who had operations work experience.

An implication of the research results is that education and experience background can influence goal constraint set selection and hence, choice from alternatives. A built-in bias toward considering particular constraints as more goal-like may develop through the processes of formal education and gaining work experience. Identification of those backgrounds that are more likely to produce goal-constraint bias may prove useful to the formulation of personnel placement policies, positional indoctrination programs, and personnel job rotation. However, further research designed to identify more narrowly defined backgrounds, that do or do not exhibit bias, would be called for to gain data necessary for specific programs.

APPENDICES

APPENDIX A
QUESTIONNAIRE

PROBLEM 1

Assume a mythical Air Force has determined there is a need for a specified number of light observation airplanes. Preliminary developments indicated airplanes meeting all specification minimums could be produced for not more than \$250,000 each. Funding has been completed and the OK has been given to select an airplane design and award a fixed price contract for its production. Requirements that must be met among others are that the cost cannot exceed \$250,000 per airplane and the airplane must be capable of staying airborne for at least 3 hours under certain stated conditions. Other things equal, the lower the cost per airplane, the more desirable is a particular design. Likewise, other things equal, the greater the endurance above the 3 hour minimum, the more desirable is a particular design.

Three airplane designs meet all the constraints. They are considered equal in respect to all requirements and specifications except the endurance capability and total unit cost. Airplane 1 is capable of 3 hours and 10 minutes of flight and will cost \$190,000 per plane. Airplane 2 has an endurance capability of 3 hours and 30 minutes and will cost \$210,000. Airplane 3's endurance is 4 hours and the cost per plane will be \$240,000. You have been asked to recommend the purchase of one of the three designs. You understand that decisions of this magnitude have been made at your level in the past and have been approved by military and government officials. You may rely on the endurance and cost figures with 100% confidence.

Which design would you recommend for purchase?

Airplane 1 (3 hours & 10 minutes endurance/\$190,000) _____

Airplane 2 (3 hours & 30 minutes endurance/\$210,000) _____

Airplane 3 (4 hours endurance/\$240,000) _____

-- Please record your choice on the --

Question/Answer Form

PROBLEM 2

Assume you are performing duty as an Aeronautical Engineer. In general, the Aeronautical Engineer conducts and manages research, design, development, installation, modification, and test of aircraft. Among his possible duties and responsibilities; he designs and develops aircraft; guided missiles, and related aeronautical equipment, engages in continuous development and modification and establishes engineering requirements to improve aircraft, guided missiles, and related aeronautical equipment. He develops design studies and monitors studies contracted to manufacturers, integrates design data concerning such factors as aerodynamic configurations, structural limitations, propulsion, mechanical and hydraulic requirements, components, systems, crew station arrangement, and safety devices. He evaluates plans and specifications for aircraft, guided missiles, and aeronautical equipment, considering such factors as military characteristics, fulfillment of performance requirements, compromises imposed by engineering, and other limitations such as cost, ease of maintenance and operation, methods of construction, feasibility, weight, and availability of materials. He recommends acceptance or nonacceptance of aircraft, guided missiles, and related aeronautical equipment.

You are a member of a panel of aeronautical engineers that have been tasked with evaluating several alternative means of increasing the ammunition capacity of a particular fighter aircraft. You are to recommend the best alternative in terms of the effect on aircraft speed and cost of modification. Any modification that would result in a loss of over 50 knots in speed is considered unacceptable. Likewise any modification that will cost more than \$175,000 per airplane is unacceptable. The lower the cost of modification and the less the reduction of aircraft speed, the more preferable the alternative.

Three alternatives are feasible (meet the speed, cost, time, and all other constraints). Alternative 1 involves mounting guns in pods at a cost per plane of \$125,000. Speed capability will be reduced by 50 knots. Alternative 2 involves minor modification of the fuselage exterior and rearrangement of some interior components. Cost will be \$150,000 per plane. Speed capability will be reduced by 25 knots. Alternative three involves making more space available internally by "miniaturizing" and relocating subsystem components. This will result in a cost of \$175,000 per plane. Aircraft speed capability will be virtually unaffected. The speed reduction and cost figures for each of these alternatives are known with 100% certainty. Other performance characteristics will not be adversely affected by any of the modifications.

Which of the three modification alternatives would you recommend?

Alternative 1 (minus 50 knots/\$125,000) _____

Alternative 2 (minus 25 knots/\$150,000) _____

Alternative 3 (no speed loss/\$175,000) _____

-- Please record your choice on the --

Question/Answer Form

PROBLEM 3

A Procurement Officer may be required to perform any of a number of functions. In general, the Procurement Officer manages procurement activities and advertises, negotiates, awards, prepares, and administers contracts to acquire supplies and services through central and base procurement programs. He may be required to contract for supplies and services including end items of supplies and equipment, aircraft spares, aircraft missiles, support equipment, construction, utilities, architect-engineer, maintenance of facilities, systems and equipment, teaching and courses of instruction, flight instruction, airlift, and communications. He analyzes and acts on requests for purchases; determines the proper method of procurement and type of contract; negotiates new procurements and contract changes; holds formal bid openings; awards contracts; prepares and assembles contracts to accurately state contractual agreements; insures compliance with all statutory and regulatory requirements; administers contracts to completion; and terminates contracts for the convenience of the Government and for default. He considers price, quality, contractor personnel and physical facilities and capabilities in awarding contracts.

Assume you are a Procurement Officer and have been directed to decide which of several manufacturers should be awarded a contract for a large number of a new type "parachute" flare. Only flares costing \$55 each or less and not exceeding a certain maximum weight are considered. Three companies' products meet all specifications and are otherwise equal except for weight and unit cost. Other things equal, the lower the unit cost (below the \$55 per flare maximum), the better. Also, other things equal, the more improvement (reduction) in weight from the maximum allowable, the better. However, as mentioned, other things are not equal. Weight and cost tend to move in opposite directions. Company 1's flare is at the maximum weight but costs the least -- \$50 per flare. Company 2's flare costs \$52 but is lighter so that it is possible for a tactical airplane to carry 4% more of these flares than Company 1's flares. Company 3's flares are lighter yet. An airplane can carry 10% more of these flares than Company 1's. However, the per unit cost is correspondingly higher at \$55.

Because there are no non-conflicting criteria that can be used to determine a "best" choice, you have been called upon to judge the three products in terms of the known cost and weight differences and decide the issue.

Which company would you award the flare contract?

Company 1 (max. weight-basic load of flares/\$50 per flare) _____

Company 2 (lighter weight/carry 4% more flares/\$52 per flare) _____

Company 3 (lighter weight-carry 10% more flares/\$55 per flare) _____

-- Please record your choice on the --

Question/Answer Form

AU Survey Control Number AU-56

QUESTION/ANSWER FORM

1. What is your grade? _____ branch of service? _____
2. What AU school are you enrolled in? _____
3. Read problem 1 and answer here.

Which design would you recommend be purchased?

Airplane 1 (3 hours & 10 minutes endurance/\$190,000) _____

or

Airplane 2 (3 hours & 30 minutes endurance/\$210,000) _____

or

Airplane 3 (4 hours endurance/\$240,000) _____

Please explain briefly your reason for this choice.

4. List your college level education. Include information on partially complete programs.

	Years of college	Type of degree	Major field of specialization	Minor fields if applicable
Undergraduate				
Graduate				
Graduate				

5. Read problem 2 and answer here.

Which of the alternatives would you recommend?

Alternative 1 (minus 50 knots/\$125,000) _____

or

Alternative 2 (minus 25 knots/\$150,000) _____

or

Alternative 3 (no speed loss/\$175,000) _____

Please explain briefly your reason for this choice.

6. List a brief resumé of your adult civilian and military work experience. Places and units of assignment are not important. Job title, speciality title (and code) and approximate period of time in each job will usually be sufficient. Include only permanent duty assignment jobs. For example, a mythical resumé might be: pilot training 1½ yrs, C-124 co-pilot and pilot 4 yrs, C-135 pilot 3 yrs, AFIT MBA student 1½ yrs, System Program Management Officer (AFSC 2944) with duty as Program Control Officer 1½ yrs, C-7A pilot 1 yr, ACSC. (Chronological order is not necessary.)

Resume: _____

7. Read problem 3 and answer here.

Which company would you award the contract?

Company 1 (max. weight-basic load of flares/\$50 per flare) _____

or

Company 2 (lighter weight-carry 4% more flares/\$52 per flare) _____

or

Company 3 (lighter weight-carry 10% more flares/\$55 per flare) _____

Please explain briefly your reason for this choice.

APPENDIX B
EDUCATION AND EXPERIENCE
BACKGROUND CATEGORIES

TABLE 5
EDUCATIONAL CATEGORIES BY FIELD OF SPECIALIZATION
(representative fields of study)

Broad Category	Sciences and Applied Fields (10)		Social Sciences, Humanities, and Arts (20)		Economics Based Fields (30)
Sub Categories	Physical, Biological (11)	Applied Fields (12)	Social Sciences (21)	Arts and Humanities (22)	
Fields of Specialization	Biological Sciences (18) Physical Sciences (19)	Mathematics (17) Metallurgy (15) Education (16) Agriculture (15) Military Sc. (15) Medical and Dental (14) Pharmacy (14) Law (14) Industrial Arts (15) Computer Sc. (15) Physical Ed. (16) Engineering (except Industrial) (13) Geology (15) Architecture (15)	Political Sc. (26) Psychology (24) Sociology (24) Anthropology (24) Geography (27)	Literature (28) Languages (28) English (28) Fine Arts (29) Music (29) Philosophy (23) Speech (28) History (23)	Agricultural Economics (31) Public Administration (32) Economics (31) Operations Research (33) Management (32)

Note:

The two digit numbers following the fields or groups of fields of specialization are codes used in categorizing individual subjects.

TABLE 6

WORK EXPERIENCE CATEGORIES

Category/ Related Career Areas	Career Areas	Utilization Fields	Officer Specialty Codes	Basic Orientation
Operations	Operations	Pilot	10_11_12	Using Equipment to Accom- plish Organiza- tion's Mission
		Navigator-Ob- server	15_14_	
		Aircraft Control	16_	
		Weapons Director	17_	
		Missile Opera- tions	18_	
		Flying Safety	19_	
		Safety	20_	
		Space Systems Special Ops		
Scientific- Engineering- Maint.-R&D	Scientific & Development Engineering	Weather	25_	Making and Repairing Things
		Scientific	26_	
		Research & De- velopment	27_	
		Management Development Engr.	28_	
	System Pro- gram Mgmt	Systems Program Management	29_	
	Communica- tions Elec- tronics	Comm-Elect.	20_	
	Electronic & Maint. Engineering	Missile Maint.	30_	
		Avionics	32_	
Technical	Materiel	Aircraft Maint.	43_	Spending
		Munitions	46_	
		Civil Engr.	60_	
		Cartography	57_	
		Transportation	60_	
		Supply Services	62_	
		Fuels	63_	
		Supply Mgmt	64_	

TABLE 6--Continued

Category/ Related Career Areas	Career Areas	Utilization Fields	Officer Speciality Codes	Basic Orientation
Support (Material & Fiscal)		Procurement Logistics	65_ 66_	Money
	Comptroller	Financial Data Automation Management Analysis	67_ 68_ 69_	
Technical Support (Other)	Personnel Resources Management	Administration Personnel Manpower Mgmt Educ. & Training	70_ 73_ 74_ 75_	Facilita- ting Things
	Information	Information	79_	
	Intelligence	Intelligence	80_	
	Security Police	Security Police	81_	
	Special In- vestigation	Special Investi- gation and Counter-intel- ligence	82_	
	Other Mis- cellaneous	Band Attache	87_	
Professional	Legal	Legal	88_	Helping Humans
	Chaplain	Chaplain	89_	
	Medical	Physician Health Svs Mgmt Biomedical Svs Dental Nurse Veterinary	90_ 91_	

Source: Adapted from Air Force Manual 36-23, 13 June 1969
and Air Force Regulation 36-23, 30 Jun 1959.

APPENDIX C
TEST DATA--HYPOTHESES OF
COMMON CHOICE

TABLE 7
 χ^2 ONE-SAMPLE TEST DATA--EDUCATION

Category (Role/Education/ Experience)	Most Frequently Chosen Alternative			Not Most Frequently Chosen Alternatives			Number of Observations (N)	X ²
	Alternative Number	Frequency of Occurrence		Alternative Numbers	Frequency of Occurrence			
		Observed	Hypothetical (1/3 of N)		Observed	Hypothetical (2/3 of N)		
N 0000	1	8	5.33	2, 3	8	10.67	16	1.32
P 0000	3	9	5.33	1, 2	7	10.67	16	2.83
C 0000							14	no test
N 1000	1	86	65.00	2, 3	109	130.00	195	9.70**
P 1000	3	128	64.00	1, 2	64	128.00	192	94.51**
C 1000	3	118	64.66	1, 2	76	129.32	194	64.77**
N 1010	3	31	23.33	1, 2	39	46.67	70	3.30
P 1010	3	45	23.33	1, 2	25	46.67	70	28.81**
C 1010	3	33	23.66	1, 2	38	47.32	71	4.95*
N 1030	1	22	15.66	2, 3	25	31.32	47	3.27
P 1030	3	24	15.66	1, 2	23	31.32	47	5.89*
C 1030	3	25	15.66	1, 2	22	31.32	47	7.49**
N 2000	1	33	28.67	2, 3	53	57.33	86	.77
P 2000	3	51	28.67	1, 2	35	57.33	86	24.93**
C 2000	3	48	28.33	1, 2	37	56.67	85	19.46**

TABLE 7 --Continued

Category (Role/Education/ Experience)	Most Frequently Chosen Alternative			Not Most Frequently Chosen Alternatives			Number of Observations (N)	χ^2
	Alternative Number	Frequency of Occurrence		Alternative Numbers	Frequency of Occurrence			
		Observed	Hypothetical (1/3 of N)		Observed	Hypothetical (2/3 of N)		
N 2020	3	7	5.33	1, 2	9	10.67	16	.39
P 2020	3	12	5.33	1, 2	4	10.67	16	10.71**
C 2020	3	11	5.67	1, 2	6	11.33	17	6.17*
N 3000	1	46	31	2, 3	47	62	93	10.17**
P 3000	3	62	31	1, 2	31	62	93	45.01**
C 3000	3	55	30.33	1, 2	36	60.67	91	28.89**
N 3030	1	11	7	2, 3	10	14	21	2.62
P 3030	3	11	7	1, 2	10	14	21	2.62
C 3030	3	13	7	1, 2	8	14	21	6.48*

^a A chi square marked with an asterisk (*) is significant at $\alpha = .05$. A chi square marked with a double asterisk (**) is significant at $\alpha = .01$. A chi square without any asterisk indicates nonsignificance and hence no reason to reject the null hypothesis at either level.

TABLE 8
 χ^2 ONE-SAMPLE TEST DATA--EXPERIENCE

Category (Role/Education/ Experience)	Most Frequently Chosen Alternative			Not Most Frequently Chosen Alternatives			Number of Obser- vations (N)	χ^2
	Alternative Number	Frequency of Occurrence		Alternative Numbers	Frequency of Occurrence			
		Observed	Hypothetical (1/3 of N)		Observed	Hypothetical (2/3 of N)		
N A	1	80	64.66	2, 3	114	129.32	194	5.11*
P A	3	133	64.33	1, 2	60	128.67	193	108.36**
C A	3	119	64	1, 2	73	125	192	69.62**
N B	1	50	39	2, 3	67	78	117	4.24*
P B	3	61	39	1, 2	56	78	117	17.78**
C B	3	62	39.66	1, 2	57	69.32	119	18.91**
N C	1	24	13	2, 3	15	26	39	12.72**
P C	3	23	13	1, 2	16	26	39	10.41**
C C	3	19	13	1, 2	20	26	39	3.49
N D	1	22	17.33	2, 3	30	34.67	52	1.50
P D	3	28	17.33	1, 2	24	34.67	52	8.95**
C D	3	34	17	1, 2	17	34	51	24.02**
N F	1	38	25.33	2, 3	38	50.67	76	8.77**
P F	3	50	25.33	1, 2	26	50.67	76	34.59**
C F	3	40	25	1, 2	35	50	75	12.62**

TABLE 8 --Continued

Category (Role/Education/ Experience)	Most Frequently Chosen Alternative			Not Most Frequently Chosen Alternatives			Number of Obs- ervations (N)	χ^2 ^a
	Alternative Number	Frequency of Occurrence		Alternative Numbers	Frequency of Occurrence			
		Observed	Hypothetical (1/3 of N)		Observed	Hypothetical (2/3 of N)		
N G	1	11	7	2, 3	10	14	21	2.62
P G	3	15	7	1, 2	6	14	21	12.05**
C G	3	13	6.66	1, 2	7	13.32	20	7.68**
N H	1 and 3 tie					46.67	71	no test
P H	3	55	23.33	1, 2	15	46.67	70	62.46**
C H	3	43	23.33	1, 2	27	46.67	70	23.63**

^a A chi square marked with an asterisk (*) is significant at $\alpha = .05$. A chi square marked with a double asterisk (**) is significant at $\alpha = .01$. A chi square without any asterisk indicates nonsignificance and hence no reason to reject the null hypothesis at either level.

TABLE 9

 χ^2 ONE-SAMPLE TEST DATA--EDUCATION AND EXPERIENCE

Category (Role/Education/ Experience)	Most Frequently Chosen Alternative			Not Most Frequently Chosen Alternatives			Number of Obser- vations (N)	χ^2
	Alternative Number	Frequency of Occurrence		Alternative Numbers	Frequency of Occurrence			
		Observed	Hypothetical (1/3 of N)		Observed	Hypothetical (2/3 of N)		
N 1000 A	1	36	26.66	2, 3	44	53.32	80	4.40*
P 1000 A	3	58	25.66	1, 2	19	51.32	77	59.26**
C 1000 A	3	48	26.66	1, 2	32	53.32	80	24.44**
N 1000 B	1	21	12.33	2, 3	16	24.67	37	8.12**
P 1000 B	3	16	12.33	1, 2	21	24.67	37	1.22
C 1000 B	3	18	12.33	1, 2	19	24.67	37	3.25
N 1000 F	1 and 3 tie						32	no test
P 1000 F	3	22	10.66	1, 2	10	21.32	32	16.53**
C 1000 F	3	21	10.66	1, 2	11	21.32	32	13.62**
N 1000 H	3	12	8.66	1, 2	14	17.32	26	1.40
P 1000 H	3	21	8.66	1, 2	5	17.32	26	24.28**
C 1000 H	3	16	8.66	1, 2	10	17.32	26	8.10**
N 1010 B	3	20	13.33	1, 2	20	26.67	40	4.28*
P 1010 B	3	23	13.33	1, 2	17	26.67	40	9.46**
C 1010 B	3	21	13.66	1, 2	20	27.32	41	5.14*

TABLE 9 --Continued

Category (Role/Education/ Experience)	Most Frequently Chosen Alternative			Not Most Frequently Chosen Alternatives			Number of Observations (N)	X ^{2a}
	Alternative Number	Frequency of Occurrence		Alternative Numbers	Frequency of Occurrence			
		Observed	Hypothetical (1/3 of N)		Observed	Hypothetical (2/3 of N)		
N 2000 A	3	17	13	1, 2	22	26	39	1.41
P 2000 A	3	20	13	1, 2	19	26	39	4.88*
C 2000 A	3	21	12.66	1, 2	17	25.32	38	7.28**
N 2000 D	1	8	5.67	2, 3	9	11.33	17	.89
P 2000 D	3	9	5.67	1, 2	8	11.33	17	2.12
C 2000 D	3	9	5.67	1, 2	8	11.33	17	2.12
N 3000 A	1	15	12.33	2, 3	22	24.67	37	.57
P 3000 A	3	31	12.33	1, 2	6	24.67	37	40.16**
C 3000 A	3	27	12	1, 2	9	24	36	26.28**
N 3000 C	1	13	6.33	2, 3	6	12.67	19	9.02**
P 3000 C	3	11	6.33	1, 2	8	12.67	19	4.12*
C 3000 C	3	10	6.33	1, 2	9	12.67	19	2.38

^aA chi square marked with an asterisk (*) is significant at $\alpha = .05$. A chi square marked with a double asterisk (**) is significant at $\alpha = .01$. A chi square without any asterisk indicates nonsignificance and hence no reason to reject the null hypothesis at either level.

APPENDIX D
TEST DATA--CHANGE IN ALTERNATIVE
WHEN ROLE CHANGED

TABLE 10
SIGN TESTS

Category	Role Being Contrasted (change in independent variable)	Change in Response ^a and Significance ^b of the Sign Test		
		+	-	Sign Test
0000	N to P	6	4	NS
	P to C	3	4	NS
1000	N to P	95	21	S**
	P to C	37	61	S**
1010	N to P	26	8	S**
	P to C	5	22	S**
1020	N to P	3	1	NS
	P to C	2	1	NS
1030	N to P	20	16	S**
	P to C	12	16	NS
2000	N to P	36	13	S**
	P to C	14	23	NS
2010	N to P	5	1	NS
	P to C	2	2	NS
2020	N to P	7	2	NS
	P to C	4	5	NS
2030	N to P	9	0	S**
	P to C	2	3	NS
3000	N to P	50	4	S**
	P to C	13	25	S*
3010	N to P	5	0	S*
	P to C	0	4	
3020	N to P	2	1	NS
	P to C	0	1	
3030	N to P	8	1	S**
	P to C	4	3	NS

TABLE 10 --Continued

Category	Role Being Contrasted (change in independent variable)	Change in Response ^a and Significance ^b of the Sign Test		
		+	-	Sign Test
A	N to P	105	18	S**
	P to C	30	58	S**
B	N to P	40	13	S**
	P to C	21	29	NS
C	N to P	20	3	S**
	P to C	7	11	NS
D	N to P	19	6	S**
	P to C	10	9	NS
E	N to P	4	3	NS
	P to C	2	6	NS
F	N to P	37	10	S**
	P to C	14	25	NS
G	N to P	10	2	S**
	P to C	3	6	NS
I	N to P	37	7	S**
	P to C	11	26	S**
0000A	N to P	3	2	NS
	P to C	1	1	NS
0000B	N to P	1	0	
	P to C	0	1	
0000C	N to P	0	1	
	P to C	2	0	NS
0000D	N to P	0	0	
	P to C	0	0	
0000F	N to P	1	1	
	P to C	0	2	NS
0000H	N to P	1	0	
	P to C	0	0	

TABLE 10--Continued

Category	Role Being Contrasted (change in independent variable)	Change in Response ^a and Significance ^b of the Sign Test		
		+	-	Sign Test
1000A	N to P	44	3	S**
	P to C	11	27	S**
1000B	N to P	18	5	S**
	P to C	9	11	NS
1000C	N to P	2	0	
	P to C	0	0	
1000D	N to P	3	3	NS
	P to C	3	2	NS
1000E	N to P	0	1	NS
	P to C	0	1	
1000F	N to P	15	4	S**
	P to C	8	9	NS
1000G	N to P	1	2	NS
	P to C	1	0	NS
1000H	N to P	12	3	S**
	P to C	5	11	NS
1010A	N to P	2	1	NS
	P to C	0	2	
1010B	N to P	10	6	NS
	P to C	3	8	NS
1010D	N to P	2	0	
	P to C	1	0	NS
1010F	N to P	8	1	S**
	P to C	1	7	S*
1010G	N to P	1	0	
	P to C	0	1	
1010H	N to P	3	0	
	P to C	0	4	

TABLE 10 --Continued

Category	Role Being Contrasted (change in independent variable)	Change in Response ^a and Significance ^b of the Sign Test		
		+	-	Sign Test
1020A	N to P	0	0	
	P to C	0	0	
1020E	N to P	0	0	
	P to C	0	0	
1020F	N to P	0	1	
	P to C	1	0	
1020G	N to P	1	0	
	P to C	0	0	
1020H	N to P	2	0	
	P to C	1	1	NS
1030A	N to P	8	1	S**
	P to C	3	5	NS
1030B	N to P	2	1	NS
	P to C	3	2	NS
1030C	N to P	1	1	NS
	P to C	1	2	NS
1030D	N to P	1	0	
	P to C	0	0	
1030E	N to P	1	1	NS
	P to C	1	1	NS
1030F	N to P	2	2	NS
	P to C	3	3	NS
1030G	N to P	2	0	
	P to C	0	0	
1030H	N to P	3	0	
	P to C	1	3	NS
2000A	N to P	14	10	NS
	P to C	9	11	NS

TABLE 10 --Continued

Category	Role Being Contrasted (change in independent variable)	Change in Response ^a and Significance ^b of the Sign Test		
		+	-	Sign Test
2000B	N to P	4	1	NS
	P to C	1	2	NS
2000C	N to P	3	0	
	P to C	0	2	
2000D	N to P	6	0	S**
	P to C	2	4	NS
2000F	N to P	3	1	NS
	P to C	0	1	
2000G	N to P	0	0	
	P to C	0	1	
2000H	N to P	6	1	NS
	P to C	2	2	NS
2010A	N to P	1	0	
	P to C	0	0	
2010D	N to P	1	1	NS
	P to C	2	1	NS
2010F	N to P	1	0	
	P to C	0	0	
2010G	N to P	1	0	
	P to C	0	1	
2010H	N to P	1	0	
	P to C	0	0	
2020A	N to P	2	0	
	P to C	1	1	NS
2020B	N to P	1	0	
	P to C	0	0	
2020D	N to P	1	1	NS
	P to C	1	1	NS

TABLE 10 --Continued

Category	Role Being Contrasted (change in independent variable)	Change in Response ^a and Significance ^b of the Sign Test		
		+	-	Sign Test
2020E	N to P	0	0	
	P to C	0	1	
2020F	N to P	1	0	
	P to C	0	1	
2020G	N to P	0	0	
	P to C	1	0	NS
2020H	N to P	2	1	NS
	P to C	1	1	NS
2030A	N to P	3	0	
	P to C	1	2	NS
2030B	N to P	0	0	
	P to C	1	0	NS
2030C	N to P	1	0	
	P to C	0	0	
2030D	N to P	2	0	
	P to C	0	1	
2030F	N to P	3	0	
	P to C	0	0	
2030G	N to P	0	0	
	P to C	0	0	
2030H	N to P	0	0	
	P to C	0	0	
3000A	N to P	24	1	S**
	P to C	3	8	NS
3000B	N to P	4	0	
	P to C	2	5	NS
3000C	N to P	11	0	S**
	P to C	4	5	NS

Table 10 --Continued

Category	Role Being Contrasted (change in independent variable)	Change in Response ^a and Significance ^b of the Sign Test		
		+	-	Sign Test
3000D	N to P	3	1	NS
	P to C	1	0	NS
3000F	N to P	3	0	NS
	P to C	1	2	
3000G	N to P	2	0	NS
	P to C	1	1	
3000H	N to P	3	2	NS
	P to C	1	4	NS
3010A	N to P	1	0	
	P to C	0	0	
3010C	N to P	2	0	
	P to C	0	2	
3010E	N to P	2	0	
	P to C	0	2	
3010H	N to P	0	0	
	P to C	0	0	
3020C	N to P	0	1	
	P to C	0	0	
3020G	N to P	1	0	
	P to C	0	1	
3020H	N to P	1	0	
	P to C	0	0	
3030A	N to P	3	0	NS
	P to C	1	1	
3030B	N to P	0	0	NS
	P to C	2	0	
3030C	N to P	0	0	
	P to C	0	0	

TABLE 10 --Continued

Category	Role Being Contrasted (change in independent variable)	Change in Response ^a and Significance ^b of the Sign Test		
		+	-	Sign Test
3030D	N to P	0	0	NS NS
	P to C	0	0	
3030E	N to P	1	1	
	P to C	1	1	
3030F	N to P	0	0	
	P to C	0	0	
3030G	N to P	1	0	NS NS
	P to C	0	1	
3030H	N to P	3	0	
	P to C	0	0	

^aPlus (+) assigned when subject chose a higher performance alternative. Minus (-) assigned when a lower performance alternative was chosen.

^bSignificance at $\alpha = .05$ indicated by S*. Significance at $\alpha = .025$ indicated by S**. Nonsignificance indicated by NS. Tests of significance are one-tailed with number of fewer signs predicted to be minus for N to P and plus for P to C.

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